



United States Department of the Interior

FISH AND WILDLIFE SERVICE

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Consultation No. 2-15-97-F-416

Mr. Brett Jackson, P.E.
Federal Highway Administration
Federal Building, Room 826
300 East 8th Street
Austin, Texas 78701

Dear Mr. Jackson:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed new highway project, U.S. Highway 183 Alternate (US 183A), located in Williamson County, Texas, and its effects on the endangered Tooth Cave ground beetle (*Rhadine persephone*) and the endangered golden-cheeked warbler (*Dendroica chrysoparia*) in accordance with Section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). The action is being proposed by the Texas Turnpike Authority Division (TTA) of the Texas Department of Transportation. The Federal Highway Administration (FHWA) is the Federal action agency that approves federal funding and oversight of the proposed project. Your November 28, 2000, request for formal consultation was received on November 29, 2000. TTA, through its private consultants, prepared a Biological Assessment (BA) for the proposed action that was submitted concurrently by FHWA to assist us in formulating this biological opinion.

Within the project BA, potential impacts to other threatened and endangered species were also considered including the Bone Cave harvestman (*Texella reyesi*), Coffin Cave mold beetle (*Batrises texanus*), black-capped vireo (*Vireo atricapillus*), bald eagle (*Haliaeetus leucocephalus*) and whooping crane (*Grus americanus*). The BA documents your determination that the proposed action will not affect these species (Section 4.0 of BA). We concur with your determination that the proposed action will not affect these species.

This biological opinion is based on information provided in the BA (FHWA and TTA 2000b), provided by FHWA to our office on November 29, 2000, which includes, as Appendices A, B, and C karst reports by George Veni and Associates and Appendix D a report on golden-cheeked warbler and black-capped vireo. Also considered in this biological opinion is the June 2000 Draft Environmental Impact Statement (DEIS) for US 183A (FHWA and TTA 2000a) and numerous meetings and telephone conversations beginning in July 1997. Additional information was provided after the initiation of formal consultation, including a field trip on January 12, 2001, a letter report on Jug Cave from Veni and Associates, dated February 23, 2001, and a letter from TTA, dated April 18, 2001, clarifying the project description. Other information from

scientific literature and information in our files were also used in preparing this biological opinion. A complete administrative record of this consultation is on file at this office.

Consultation History

Informal consultation has occurred between the Service and FHWA for a number of years regarding the proposed US 183A project. On June 3, 1996, our office provided a letter and a list of federally protected species to the Texas Department of Transportation (TxDOT) during the early stages of US 183A planning (the consultation number 2-15-96-I-160 was used, now updated to reflect the current consultation number 2-15-97-F-416). In 1997, TxDOT, through its consultants, provided our office with copies of studies conducted on Big Oak Cave, known to contain the federally listed endangered Tooth Cave ground beetle. A meeting with TxDOT and their consultants on October 3, 1997, discussed the specific potential impacts to Big Oak Cave associated with the planned US 183A project and determined the needs for additional karst investigations.

During the summer of 1998, responsibility for the US 183A project was transferred from TxDOT Austin District to TTA for planning as a possible toll road facility. On September 23, 1998, the Service sent a letter to Turner, Collie and Braden Inc. (TCB), working on behalf of TTA, with general information regarding potential impacts of the proposed US 183A project on species listed as threatened or endangered. On October 29, 1998, Nathan Allan, of the Service, attended a Major Investment Steering Committee meeting. Informal discussion meetings between the Service and TTA and their consultants were held on November 11, 1998; and January 28, March 12, April 16, August 30, September 2, and September 20, 1999. These meetings discussed the results of field investigations as well as potential impact avoidance options and potential mitigation scenarios. The primary issues being considered were related to the impacts to the Tooth Cave ground beetle that occurred in Big Oak Cave. The FHWA invited the Service to be a cooperating agency for the US 183A Final EIS by letter on July 23, 1999, which the Service declined due to a lack of personnel resources.

In November 1999, TTA distributed a Draft EIS for public and agency review. In December 1999, that Draft EIS was discontinued due to a change in the project limits. The southern terminus of the project was extended to RM 620. This project change resulted in additional studies being required. These studies, during the spring of 2000, resulted in the discovery of the Tooth Cave ground beetle in Jug Cave in June 2000.

On March 1, 2000, TTA provided the Service with an August 1999 report prepared by SWCA, Inc. regarding potential habitat of golden-cheeked warblers and black-capped vireos (SWCA 1999). On May 11, 2000, the Service met with TTA and their consultants to discuss potential impacts of the proposed project on these endangered birds. We had previously agreed that additional presence/absence surveys needed to be done on the Alternative 1 (preferred) route. Additional surveys were being conducted in the spring of 2000.

By memorandum, dated August 3, 2000, copied to TTA, the Service provided comments on the June 2000 DEIS for the proposed project. Initiation of formal section 7 consultation was

planned. The Service requested that FHWA provide a draft biological assessment for the Service's review and comment before the initiation of formal consultation.

The FHWA formally requested the initiation of Section 7 consultation in a letter dated November 28, 2000, received on November 29, 2000, accompanied by the final BA, which concluded that the project was likely to adversely affect the federally listed endangered Tooth Cave ground beetle and golden-cheeked warbler. The Service confirmed the initiation of formal Section 7 consultation in a letter dated December 22, 2000.

In meetings on December 22, 2000 and January 10, 2001, further discussions regarding the contents of the BA, potential conservation measures to include in the proposed action and outstanding issues related to the golden-cheeked warbler were conducted. A field visit was conducted by Nathan Allan and Lisa O'Donnell of the Service, Stacey Benningfield, TTA, and Kristin Terpening of TC&B on January 12, 2001, to review the warbler habitat determinations and impact assessment and to view the locations of Big Oak Cave and Jug Cave.

On April 18, 2001, FHWA provided the Service with a letter from TTA amending the BA to modify the project description to reflect updated information regarding impacts to potential golden-cheeked warbler habitat and to clarify the project description to include a commitment to specific conservation actions for the minimization of impacts to the two listed species.

In addition to the meetings listed above, extensive informal discussions have occurred via phone and email between the Service, TTA, FHWA, and project consultants staff (primarily Hicks & Company and TCB).

The Service provided a draft of this biological opinion to the action agencies by letter dated April 24, 2001. The Service met with FHWA and TTA on April 30, 2001, to discuss the draft biological opinion. The Service made changes in the biological opinion, as requested by TTA and FHWA. TTA disagrees with the Service's determination that the area of impacts to the Tooth Cave ground beetle should include 150 meters (492 feet) beyond the project right-of-way (ROW) corridor. The Service acknowledges this position.

BIOLOGICAL OPINION

I. Description of Proposed Action

The process of identifying a preferred route alternative for US 183A is discussed in detail in the Draft Environmental Impact Statement (DEIS) prepared by the FHWA and TTA (FHWA 2000a). Alternatives considered are described in Section 2.3 of the DEIS, an evaluation of the alternatives, and recommendation regarding a preferred alternative, are summarized in Section 4.15, and the preferred alternative is described in detail in Section 2.4. In general, the proposed facility would consist of a controlled access freeway or toll road operating within a 400-foot ROW corridor totaling approximately 12 miles in length. The study corridor begins at the intersection of US 183 and RM 620 and extends north to the existing US 183 approximately three miles north of the City of Leander and immediately south of the South San Gabriel River bridge (Figure 1). Detailed design information is available for review in the DEIS sections described above.

The proposed roadway would generally operate within a 400-foot ROW corridor. Variations in the width may occur due to intersections, ramps and bridges. The ultimate build-out would provide for 3-lane frontage roads in each direction, two concurrent flow high-occupancy-vehicle (HOV) lanes, and six main lanes (minimum) plus one to four auxiliary lanes (see Section 2.6.1 of FEIS). An interim toll road facility may feature fewer travel lanes and no HOV lanes initially.

The roadway typical section for the ultimate facility would include two 58-foot water quality swales and two 12-foot grassy roadside strips (when feasible within the proposed ROW); thus, approximately 65% of the roadway section would consist of impervious cover. Water quality filtration ponds would be included adjacent to discharge points into major localized creeks.

The proposed US 183A would include a number of design elements intended specifically to minimize impacts on listed species, as detailed in Section 3.0 of the BA. These include substantial design modifications intended to avoid direct impacts to Big Oak Cave, as discussed in Section 3.1 of the BA. The main lanes and northbound frontage roads will be separated from the southbound frontage roads to allow for the drainage area of Big Oak Cave to be avoided from direct impact (Figure 2).

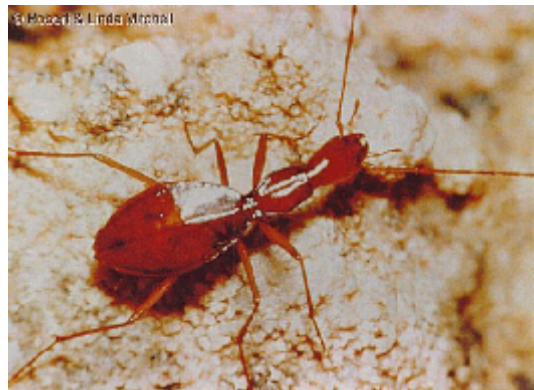
Included in the proposed action are specific conservation measures for the listed species to minimize the overall effects to the species from the unavoidable impacts of the project. In order to minimize the impacts to the golden-cheeked warbler, FHWA and TTA has included in the project description a financial contribution to a conservation fund of \$1,080,225. This amount was determined through coordination with the Service based on the amount and quality of golden-cheeked warbler habitat estimated to be impacted by the project. In addition FHWA and TTA will establish one or more karst preserves to protect at least two distinct caves known to contain the Tooth Cave ground beetle. More specific details of both of these conservation actions will be developed through ongoing planning in close coordination between FHWA, TTA and the Service.

For the purpose of this consultation, the Service defines the action area for the proposed project to include portions of northwest Travis County; southwest Williamson County; and southeast Burnet County (Figure 5). This area will encompass all of the potential project effects, including direct, indirect, beneficial and cumulative effects to both species. This project area includes the entire range of the Tooth Cave ground beetle (Figure 4). The direct and indirect effects analysis included the proposed project ROW for the preferred alternative route and an area of 150 meters (492 feet) beyond this corridor for Tooth Cave ground beetle and an area 300 feet beyond this corridor for golden-cheeked warblers. Efforts related to karst invertebrates were focused on the southern segment of the proposed roadway because it occurs on karst zones known or believed to contain endangered species (Karst Zones 1 and 2, respectively) according to Veni and Associates (1992) (Figure 3). Potential golden-cheeked warbler habitat was identified at several locations throughout the study corridor, as illustrated in Section 2.2.2 of the BA. The analysis for beneficial effects and cumulative effects included a larger area to encompass all potential effects to the species.

II. Status of the Species/Critical Habitat

a. Tooth Cave ground beetle

The Tooth Cave ground beetle (*Rhadine persephone*) was listed as federally endangered on September 16, 1988 (53 Federal Register 36029) due to increased urban development, pollution, vandalism, and red imported fire ants (*Solenopsis invicta*).



Tooth Cave ground beetle is a reddish-brown, moderately robust and convex beetle that possesses rudimentary eyes and reaches a total length of 7-8 mm at maturity. This species is the largest and most active of the Austin-area endangered karst invertebrates. The type specimen was collected from Tooth Cave in May, 1965 by R.W. Mitchell, T.C. Barr, Jr., and W. M. Andrews. The type specimen was described as follows: head half as wide as long, neck approximately 57 to 59% of greatest head width, pronotum 0.07 inches long and 0.04 inches wide, elytra 0.17 inches long by 0.09 inches wide, and antenna 0.27 inches long. The *Rhadine persephone* is distinguishable from the closely related species *Rhadine subterranea* by its more robust build and shorter pronotum. These beetles are usually found under rocks but can be seen walking on damp rocks and silt within caves. Although the feeding behavior is relatively unknown, *R. subterranea* is thought to be a predatory generalist that feeds on a wide range of insect species. A closely related species, *R. subterranea*, has been observed feeding on cave cricket eggs, cave cricket body parts, and springtails.

There is little specific information on the life history and specific habitat requirements of the Tooth Cave ground beetle. This is largely because troglobites (animals that complete their life cycle underground and exhibit adaptation to the subsurface environment such as absence of eyes) are subterranean, inconspicuous, and difficult to study (Mitchell 1971b; Chandler 1992). However, we know that the Tooth Cave ground beetle is an obligate cave dweller whose

continued existence depends on the ecological stability of the karst environments in which it is found. Although little information is available on its microhabitat requirements, its macrohabitat requirement (caves and possibly interstitial spaces associated with caves) is clearly defined.

The Tooth Cave ground beetle is known to have a limited distribution within central Texas and includes only the Cedar Park and Jollyville Karst Fauna Regions (KFRs) as delineated by Veni (1992) (Figure 4). The US 183A project occurs within the Cedar Park KFR. The Cedar Park KFR has at least six karst fauna areas (KFAs) known to support the *Rhadine* beetle including: (1) Big Oak Cave (which would be impacted by the construction of US 183A), (2) Raccoon Cave; (3) the Buttercup Creek Cave cluster; (4) Jug Cave (which would also be impacted by US 183A) (5) Broken Arrow Cave; and (6) Rolling Rock Cave (see Appendix A of the BA for additional information regarding the latter two features). An additional KFA occurred at the site of the present Lakeline Mall, which eliminated completely at least one cave inhabited by the Tooth Cave ground beetle, and severely impacted another.

KFAs are defined in the species recovery plan (USFWS 1994, p. 87) as:

“an area known to support one or more locations of a listed species and is distinct from other karst fauna areas by geologic and hydrologic barriers to the movement of water, contaminants, and troglobitic fauna. Karst fauna areas should be far enough apart so that if a catastrophic event (for example, contamination of the water supply, flooding, disease) were to destroy one of the areas, that event would not likely destroy any other area occupied by the species.”

The primary threat to the Tooth Cave ground beetle is the loss of habitat due to encroaching urban development. The species occurs in an area of central Texas that is undergoing continued urbanization. Alterations of topography, vegetation and drainage patterns from urbanization can ultimately lead to changes in the moisture regime, nutrient loading, and increases in sedimentation into the karst ecosystems. Karst environments are also highly susceptible to groundwater contamination. Sources of this contamination include urban runoff, agricultural pesticide use, transportation and pipeline spills and landfills.

The recovery plan for this species (USFWS 1994) calls for the protection of at least three KFA's within each KFR in order to achieve recovery of the species. At the time the recovery plan was written, the Tooth Cave ground beetle was known from 17 caves in the Cedar Park KFR and ten caves in the Jollyville Plateau KFR. Recent discoveries have increased the number of caves known to harbor the species, particularly in the Buttercup Creek area where 25 caves were found to contain the Tooth Cave ground beetle. All of these caves are considered one KFA because of strong hydrological connections.

The recovery plan (USFWS 1994, p. 87) defines the protection of KFAs:

“To be considered “protected”, a karst fauna area must be sufficiently large to maintain the integrity of the karst ecosystem on which the species depend(s). In addition, these areas must also provide protection from threats such as fire ants, habitat destruction, and contaminants.”

The Cedar Park KFR (where the proposed action is located) has at least six distinct areas known to support the Tooth Cave ground beetle. At present, three KFAs (a part of the Buttercup Creek cluster, Broken Arrow Cave and Rolling Rock Cave) have some level of protection. Testudo Tube (28 acres), Lime Creek (494 acres) and Buttercup Creek (163 noncontiguous acres) are the only preserve systems containing Tooth Cave ground beetle in the Cedar Park KFR.

The Lime Creek Preserve is 494 acres owned and managed by the City of Austin since 1992 as part of the Balcones Canyonlands Preserve (COA 1997) and contains Broken Arrow and Rolling Rock caves. The tract was included in the preserve lands as part of the Balcones Canyonlands Habitat Conservation Plan (HCP) (USFWS 1996a). The tract provides habitat for both the golden-cheeked warbler and the Tooth Cave ground beetle. The majority of the tract is in Travis County, with a small western portion in Williamson County. The Lime Creek Preserve is located northwest of Lime Creek Road, about 3 miles east of Sandy Creek arm of Lake Travis. Broken Arrow Cave is located on the northeast portion of the preserve and Rolling Rock Cave is on the southeast portion, about 1.5 kilometers (0.9 miles) from Broken Arrow Cave. Both caves were confirmed to contain Tooth Cave ground beetle in 1991 (Reddell 1991). The two caves were investigated by George Veni and Associates and found to be hydrologically distinct, supporting the conclusion that they should be considered two separate KFA's (letter reports dated May 2 and October 20, 1999). Both caves are protected from human impacts by the City of Austin. The tract is adjacent to a larger preserve to the south which is owned and managed by the Travis County Audubon Society.

A significant portion of the Buttercup Creek cluster is currently undergoing residential development, as authorized by a Section 10(a)(1)(B) permit (USFWS 1999). The entire tract is about 438 acres, of which about 163 acres was conserved in several non-contiguous preserves to protect 25 caves found to contain the Tooth Cave ground beetle. Most of the conservation areas are small and will be surrounded by residential homes. The largest contiguous preserved area is 56 acres.

Testudo Tube Preserve is about 28 acres and is located adjacent to the Buttercup Creek cluster and is considered part of the Buttercup Creek KFA. The preserve is managed as part of the mitigation under the HCP for Lakeline Mall (USFWS 1992a).

The only other known caves in the Cedar Park KFR which have been confirmed to contain the Tooth Cave ground beetle are on undeveloped private properties just west of Cedar Park south of the Buttercup Creek cluster. These caves may be part of the Buttercup Creek KFA, but not enough information is available on these caves to make a determination at this time.

Karst invertebrate general ecology

Troglobites require stable, mild temperatures, and constant, high humidity (Barr 1968; Mitchell 1971a). The temperatures in caves are typically the average annual temperature of the surface habitat and vary much less than the surface environment (Howarth 1983; Dunlap 1995). Relative humidity in a cave is typically near 100% for caves supporting troglobitic invertebrates (Elliott and Reddell 1989). Many of these species have lost the adaptations needed to prevent desiccation in a drier habitat (Howarth 1983) or the ability to detect and/or cope with more

extreme temperatures (Mitchell 1971a). To maintain adequate conditions, it is important to maintain an adequate drainage area to supply moisture to the cave and connected karst areas and to maintain the surface plant communities that insulate the karst system from excess drying and from more extreme temperature fluctuations.

Water enters the karst ecosystem through the surface and subsurface. Because these karst ecosystems depend on air-filled voids with some water infiltration, a reduction in moisture levels can eliminate most of the troglobitic fauna, since they rely on moist air environments. Increased moisture levels can result in flooding and elimination of air-breathing species. Water infiltration also brings nutrients into the subsurface system, and thus alteration of the quantity of surface water inflow may also change nutrient inflow. Since troglobitic species rely on nutrients from the surface for their existence, any alteration of inflow can cause an adverse impact.

In areas where karst features are extensive, caves may be connected to other subterranean habitats to constitute a single functioning system. During periods of dryness or temperature extremes, the troglobites may retreat into the interstitial spaces, where the physical environment is more stable (Howarth 1983).

Because of low levels of sunlight in caves, karst ecosystems depend on surface plant and animal communities for nutrient input. These ecosystems receive nutrients from the surface in the form of leaf litter and other organic debris that washes or falls into the caves, tree and other vascular plant roots, and the feces, eggs, and/or dead bodies of animals that forage on the surface and bring nutrients into the cave (Barr 1968; Poulson and White 1969; Howarth 1983). The endangered invertebrates are predators near the top of their food chain. Thus, any habitat changes that affect their food sources or any part of that food chain may, in turn, affect the Tooth Cave ground beetle.

The cave cricket (*Ceuthophilus* sp.) is a particularly important nutrient component (Barr 1968) found in most caves in Texas (Reddell 1966). A troglonexene (a species that regularly inhabits caves for refuge, but normally returns to the surface to feed), it forages on the surface at night and lays eggs and roosts in caves during the day. A variety of troglobites (obligate subterranean species that are unable to survive on the surface and have special adaptations to the cave environment), including the Tooth Cave ground beetle and its prey species, are known to feed on cave cricket eggs (Mitchell 1971b), feces (Barr 1968; Poulson et al. 1995), and/or on the adults and nymphs directly (Elliott 1994). Recent research indicates that cave crickets generally forage within 50 meters (164 feet) from karst features, and have been observed up to 60 meters (197 feet) (Elliott 1994) from karst features. They are scavengers or detritivores, feeding on dead insects, carrion and some fruits, but do not feed on foliage. Cave crickets are sensitive to temperature extremes and drying. Mice (*Peromyscus* spp.) and fire ants (Elliott 1993; Elliott 1994) are documented predators of *Ceuthophilus* cave crickets in Texas.

The daddy longlegs harvestman (*Leiobunum townsendi*) is another widespread troglonexene commonly found in Texas caves (Reddell 1965). It, and other surface invertebrates, may enter caves and help contribute nutrients. These troglonexenes are typically leaf litter and soil dwelling species, flying species, or stream species in caves with flowing water. Such documented invertebrates in caves include, but are not limited to, snails, earthworms, pillbugs, scorpions,

spiders, mites, springtails, bristletails, harvestmen, silverfish, ants, leafhoppers, thrips, beetles, weevils, moths, and flies (Reddell 1965, 1966).

Raccoons are also ecologically important in many cave communities. The presence of bones and droppings in hundreds of Texas caves indicates raccoons are frequent cave inhabitants, using them for nests and sources of water (Reddell 1967). Their feces provide a rich medium for the growth of fungi and, subsequently, potentially localized population blooms of several species of collembola, which are prey to other troglobites. Troglobites have also been observed feeding on fungi growing on scat and dead bodies of raccoons (Elliott 1994). Although raccoons have frequently been described as “urban” wildlife, which implies they are home in highly industrial or downtown areas, studies on “urban” raccoons show raccoons in more residential or suburban habitats than highly urban areas (Hadidian et al. 1991; Rosatte et al. 1991) although they might exist at higher densities in those suburban areas than in the adjacent rural areas (Rosatte et al. 1991).

Native mice (*Peromyscus* sp), other small mammals, and several species of reptiles and amphibians are common in many caves (Reddell 1967; Reddell 1999) and likely introduce nutrients into karst ecosystems in a similar manner. In low densities, mice provide a source of nutrients for karst ecosystems. However, mice have been observed preying on cave crickets and other invertebrates, and their presence in high densities could be detrimental to the karst ecosystem.

The surface plant community supports the karst ecosystem function both directly and indirectly. Dead and decaying plant material can fall or be washed into caves. Root masses reaching cave openings through soil and rock fissures may also provide direct nutrient input to shallow caves (Howarth 1983, 1988). A survey of 21 caves on the Edwards Plateau revealed that roots of six species reached caves (Jackson et al. 1999). Maintaining a balanced native woodland community over the caves is needed to support this direct nutrient input.

Indirectly, the plant community also supports cave ecosystem dynamics by providing the habitat matrix used by surface animal communities that contribute nutrient input to the karst ecosystem, including habitat needed for food, forage, and shelter by mammals, invertebrates, amphibians, and reptiles. When plant species composition is altered, subsequent changes also occur in animal communities (Lovejoy and Oren 1981; Harris 1984; Mader 1984; Thompson 1985; Lovejoy et al. 1986; Yahner 1988; Fajer et al. 1989; Kindvall 1992; Tschardtke 1992; Keith et al. 1993; Hanski 1995; Lindenmayer and Possingham 1995; Bowers et al. 1996; Hill et al. 1996; Kozlov 1996; Kuussaari et al. 1996; Turner 1996; Mankin and Warner 1997; Burke and Nol 1998; Didham 1998; Suarez et al. 1998; Crist and Ahern 1999; Kindvall 1999). These changes can be undesirable because of the potentially negative effects to species and nutrient cycling processes important in cave dynamics.

In addition to providing nutrient input, the surface plant community buffers the karst ecosystem from changes in the temperature and moisture regimes, pollutants entering from the surface (Biological Advisory Team 1990, Veni and Associates 1988), and other factors such as sedimentation from soil erosion. Preserving native vegetation also helps control certain exotic

species, such as red-imported fire ants (*Solenopsis invicta*), that compete with and/or prey upon the listed species and other karst fauna.

b. Golden-cheeked warbler

The golden-cheeked warbler (GCW) was emergency listed as federally endangered on May 4, 1990 (55 FR 18844) because of the imminent and ongoing destruction of habitat. The final rule, without critical habitat designated, was published December 27, 1990. The small neotropical migrant is 4.5 to 5 inches long with a wingspan of 7.75 inches. The male has a black back, throat, and cap; and yellow cheeks with a black stripe through the eye. Females are similar, but less colorful. Lower breast and belly of both sexes are white with black stripes on the flanks.



The golden-cheeked warbler breeds only in the mixed Ashe juniper-deciduous woodlands of the central Texas Hill Country west and north of the Balcones Fault Line and winters in the highland pine-oak woodlands of southern Mexico and northern Central America. The GCW requires the shredding bark of mature Ashe junipers for nesting material and forages for insects in Ashe juniper and various deciduous tree species, especially Texas oak (*Quercus buckleyi*). The males arrive in central Texas around March 1 and begin to establish breeding territories which they defend against other males by singing from visible perches within their territories. The females arrive a few days later but are more difficult to detect in the dense woodland habitat. Eggs are generally incubated in April and, unless there is a second nesting attempt, nestlings fledge in May to early June. By early August, the GCWs begin their migration south.

The entire breeding range of this bird is found within 33 counties in the Edwards Plateau and the Lampasas cut plain of Texas (Figure 5). Predominant deciduous species used include live oak, Texas oak, scaly bark oak, cedar elm, Mexican persimmon, hackberry, Texas ash, bald cypress, Arizona walnut, big-tooth maple, Lacey oak, and sycamore. It is the only bird species whose entire nesting range is confined to Texas. Average nest height is 15 feet above ground, ranging from 5 to 32 feet above ground. Usually three or four eggs are laid. GCWs feed almost entirely on insects and arachnids such as caterpillars, green lacewings, cicadas, katydids, walking sticks, flies, adult moths, small butterflies and spiders.

The greatest threats to the GCW continue to be loss of habitat and urban encroachment. Human activities have eliminated much GCW habitat within the central and northern parts of the range. The rate of habitat loss is accelerating as suburban developments spread into prime GCW habitat along the Balcones Escarpment, especially in the growth corridor from Austin to San Antonio. Additional threats are nest parasitism by brown-headed cowbirds and predation on eggs by red imported fire ants.

Travis County contains the greatest amounts of GCW habitat in large, contiguous blocks, and lies at the center of the species' range. There is some limited connectivity between the large habitat blocks in Travis County and other large blocks in adjacent recovery regions. Research (Robinson 1992; Donovan et al. 1995) indicates that declining populations of neotropical migrants in marginal, outlying habitats may be due to declining productivity in central populations that would normally supply emigrants to the less productive areas. Research on golden-cheeked warblers indicates that occupancy and productivity are considerably lower in "small" patches of habitat than in larger ones (Coldren 1998; Maas-Barleigh 1997).

Currently there are only three significant GCW populations receiving protection: Balcones Canyonlands Preserve (BCP), a regional 10(a)(1)(B) HCP, in Travis County (USFWS 1996a); Balcones Canyonlands National Wildlife Refuge (BCNWR) in Travis, Burnet and Williamson counties; and Fort Hood Military Reservation (Fort Hood) in Coryell and Bell counties. Outside of the BCP and the BCNWR in western Travis County, in adjacent areas of southern Travis, Williamson, Hays, and Burnet counties few large, contiguous blocks of habitat remain. Other important areas receiving only limited protection include smaller tracts of State and Federal lands throughout the range of the GCW.

Populations of golden-cheeked warblers and other neotropical migrants are less stable in small habitat patches surrounded by urbanization (Coldren 1998; Engels 1995; Arnold et al. 1996; Bolger et al. 1997; Moses 1996). GCW populations are declining in suitable habitat in the rapidly urbanizing area east of Loop 360 in Travis County. For example, GCW that formerly occupied 450 acres of habitat at Wild Basin Preserve, which is now surrounded by urban development, no longer occur there on a regular basis despite proximity to a large habitat block. Some studies indicate that the abundance of several bird species, including the GCW, is reduced within 200-500 meters (656-1640 feet) of an urban edge (Engels 1995; Arnold et al. 1996; Bolger et al. 1997; Coldren 1998). Coldren (1998) reported that GCW occupancy declined with increasing residential development and roadway width. Additional information on the status of the species can be found in the Golden-cheeked Warbler Recovery Plan (USFWS 1992b) and the Golden-cheeked Warbler Habitat Population and Viability Analysis (USFWS 1996b).

The project area is located in the eastern portion of the range of the GCW within Recovery Region 5 (USFWS 1992b). Habitat availability in this part of the range is associated with patches of oak-juniper woodlands occurring primarily along major drainages and on parcels of public land associated with the BCP and BCNWR. Much of the region has been historically cleared of dense woodlands and converted to grasslands for cattle grazing and residential/commercial development. Outside of the project area, the nearest recorded locality of the GCW is approximately 2 miles west of US 183A along Buttercup Creek. Other confirmed localities occur about 5 miles west on the BCNWR. Other areas of potential habitat in the Cedar Park / Leander area have not been surveyed for the presence of GCWs.

II. Environmental Baseline

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area, not including the effects of the proposed action.

a. Status of the species within the action area

Tooth Cave ground beetle

Extensive ground surveys throughout Karst Zones 1 and 2 found that within the US 183A project vicinity, Tooth Cave ground beetle is known from Big Oak Cave, Jug Cave and Raccoon Cave (Figures 2 and 3). Big Oak Cave is located 82 feet east of US 183 and 485 feet northeast of the Lakeline Boulevard-US 183 intersection. According to a study by Veni and Associates (1997b), the entrance to the cave is a pit 5.9 feet long, 4.9 feet deep, and 1.6 – 4.2 feet wide. Mike Wharton and Associates previously excavated the cave to a depth of 16.4 feet in 1990. Veni also suggests in all likelihood, the cave extends to a depth of approximately 33 feet to the contact with the Comanche Peak formation where lateral development is likely to be seen. Jug Cave is located approximately 33 feet east of existing US 183, 165 feet north of Lakeline Mall Drive (Lake Stop Boulevard). A survey in June 2000 encountered the Tooth Cave ground beetle and a more detailed cave description was made (Veni & Associates 2001). Raccoon Cave is located approximately 800 feet east of existing US 183 and 140 feet north of Lakeline Boulevard (Veni and Associates 1997a) and was not surveyed extensively as part of this project due to limited right-of-entry. Previous studies confirmed the presence of the Tooth Cave ground beetle in Raccoon Cave (Veni 1994).

Population estimates for any of the listed karst species are not currently available due to their rarity, inaccessibility, and secretive habits. Few individuals of each species are ever seen during a visit to a cave. Due to the limited knowledge and the subterranean nature of the karst invertebrates, an estimation of the population size in the vicinity of US 183A is not feasible to obtain. Thus, an appraisal of impacts to cave features known to contain listed species tends to focus on impacts to the cave entrance itself, its hydrologic drainage area (both surface and subsurface drainages), a minimum foraging area (typically believed to be 164 feet) for endemic cave crickets, and a minimum intact area of native vegetation to provide terrestrial ecosystem functions and buffers from edge effects of urbanization (which the Service believes to be about 69 to 99 acres).

A number of detailed investigations on caves and karst features have been completed within the study area. George Veni & Associates and James Reddell performed hydrogeological and biological investigation for Big Oak and Raccoon caves (which were known to contain the Tooth Cave ground beetle) in 1997 (Reddell 1997, Veni and Associates 1997a, 1997b). Project specific karst investigations were conducted for US 183A in several phases, as described in detail in Section 2.1.2 of the BA. In general, areas located on karst zones 1 and 2 (as identified by Veni) within two broad alternative corridors were surveyed for the presence of potential karst features by crews supervised by Dr. Veni beginning in the Spring of 1998 (Veni and Associates 1998a). Potential karst features were evaluated by Dr. Veni and ranked according to their potential to be

significant from a biological or hydrologic perspective. Route alternatives were then drawn with the intent of avoiding as many as possible of the karst features identified. Karst features within 50 meters of the proposed ROW line were excavated for both alternatives in December 1998 (later the area of concern was expanded to 150 meters for the preferred alternative) to determine whether caves were present. Where caves or substantial voids were discovered, a karst biologist (Dr. James Reddell) evaluated those features for their potential to contain habitat for listed invertebrate species. Where appropriate, biological collections were completed according to current Service survey protocols (Veni and Associates 1998b).

The decision in late 1999 to extend the southern terminus of US 183A southward from Lakeline Boulevard to RM 620 necessitated an additional karst feature survey within this small segment, which resulted in the discovery that Jug Cave (a previously known cave) would be unavoidably impacted by US 183A. Biological collections within Jug Cave in June 2000 resulted in the first discovery of the Tooth Cave ground beetle in the feature. Additional information on the hydrology of Jug Cave was provided on March 1, 2001 (Veni and Associates 2001).

No critical habitat is designated for this species, therefore, none occurs within the action area. All of the karst features and caves within the project area were thoroughly evaluated using methods from Veni (1999) and described in the project karst report (Veni and Associates 1998a) and subsequent letters (appendices to the BA). Two caves (Big Oak and Jug caves) that contain the Tooth Cave ground beetle are known to occur within or directly adjacent to the proposed project ROW. A third, Raccoon Cave, occurs within the defined project area.

The existing urban development in the project project area where these three caves occur, has already resulted in impacts to the native vegetation to provide terrestrial ecosystem functions to support the caves (Figure 6). All three caves occur adjacent to existing roads. The subsurface drainage area of Big Oak Cave is currently compromised by the existing US 183 highway. The surface drainage of Jug Cave is also impacted by the existing US 183 Highway and the footprint of the cave actually extends under the existing highway. In addition, in fall 2000, Jug Cave was severely impacted by new urbanization when a restaurant was built within about 100 feet of the opening and a driveway from the restaurant to the US 183 was built within 10 feet of the cave opening, without any protection for the cave. This construction occurred without the knowledge or approval of the Service.

The surrounding lands to the north and east of Big Oak and Raccoon caves currently provide fairly large areas of native vegetation. Besides the existing roads, the nearest urban development is the TxDOT facility to the east that is currently under construction. This facility is about 1300 feet from Raccoon Cave and about 2200 feet from Big Oak Cave. Jug Cave is completely surrounded by urban development.

Golden-cheeked warbler

Appendix D of the BA contains a detailed summary of the habitat evaluation and endangered species surveys conducted for the US 183A project. In general, the survey corridor for presence/absence of the GCW included the 400-foot ROW for the proposed US 183A and an additional 300-foot buffer on each side of the ROW for a total survey width of 1000 feet. Site

visits were made by a Service-permitted consulting biologist and properties meeting the characteristics of GCW habitat were surveyed (where right-of-entry was available) following the Service survey protocol during the Spring 2000 survey season. Golden-cheeked warblers were observed at two units along US 183A, and other units were identified where potential habitat occurred (although right-of-entry to survey was denied).

The proposed action is located at the eastern-most occurrence of the GCW in Williamson County. The habitat in this area is extremely patchy with extensive areas of urbanization and past impacts from agricultural land use (overgrazing and brush clearing). However, the proposed highway corridor transects several small patches of oak-juniper woodlands that provide some habitat for the GCW. There is not enough information available to determine population estimates for GCWs in the project area. However, based on one year of presence/absence surveys and the size and characteristics of the vegetation, the project area is likely to only be occupied by GCWs in low densities.

b. Factors affecting species environment within the action area

Tooth Cave ground beetle

All three of the known caves inhabited by Tooth Cave ground beetle within the project area are considered to already be impacted to some extent from urbanization. Big Oak Cave occurs within 82 feet of the existing US 183 and receives some runoff from the roadway. Raccoon Cave is located approximately 140 feet north of Lakeline Boulevard and about 350 feet from the proposed US 183A. Jug Cave occurs within 33 feet east of the existing US 183. Substantial development has occurred along this section of US 183, including the recent addition of the restaurant and associated driveway within about 10 feet of the entrance to Jug Cave. Consequently, the cave cricket foraging area and supporting vegetative and animal communities for the cave ecosystem occupied by the Tooth Cave ground beetle are currently fragmented and subject to runoff from the existing US 183 for these caves, before the implementation of the proposed action.

In addition, the cave openings have been modified to allow for easier human access. However, these impacts are considered minor and not likely to have significantly degraded the cave. Fire ants are already present in the area, and are locally abundant. The effects of the proposed project are both quantitative (individuals of the species would be harmed within the proposed project ROW) and qualitative (continued and increased degradation of cave ecosystem quality will occur from the proposed action).

Two previous consultations under the Endangered Species Act have occurred near the action area relating to caves containing the Tooth Cave ground beetle. Development associated with construction of the Lakeline Mall (USFWS 1992) and the Buttercup Creek (USFWS 1999) subdivision required the preparation and approval of a Habitat Conservation Plan and issuance of a Section 10(a)(1)(B) permit for the incidental take of the species. These consultations are summarized as follows.

The Service prepared an “Environmental Assessment for the Issuance of an Endangered Species Section 10(a) Permit for the Incidental Take of the Tooth Cave Ground Beetle (*Rhadine persephone*) and Bee Creek Cave Harvestman (*Texella reddelli*) During Construction and Operation of a Regional Shopping Mall Near Austin, Williamson County, Texas” in September 1991 which was approved in February 1992. This permit allowed the construction of Lakeline Mall to occur on a 116-acre site northwest of the RM 620/US 183 intersection. The permit covered impacts to 62 acres of potential take (within areas known to contain subsurface karst features) and allowed the take of two features known to contain listed species (Underline Cave and Well Trap location #6). A third feature, Lakeline Cave, was to be monitored for a 5-year period and then assumed to be taken when the small conservation area was reduced to one-half acre. A conservation plan prepared for the 10(a) permit included a number of measures, including acquisition of three karst preserve lands totaling 232 acres which include known cave locations for the Tooth Cave ground beetle and Bee Creek Cave harvestman; long term research and monitoring; preserve area management funding and support; monetary contributions to the Balcones Canyonlands Conservation Plan (BCCP); and karst educational outreach.

In August 1999, the Service prepared an “Environmental Assessment/Habitat Conservation Plan for Issuance of an Endangered Species Act section 10(a)(1)(B) permit for the incidental take of the Tooth Cave ground beetle (*Rhadine persephone*) during Construction and Operation of the Buttercup Creek’s Section 4 and Phase V and extension of Lakeline Boulevard (438 acres), Williamson County, Texas”. This action permitted residential and associated development on 275 acres of a 438-acre tract located in Cedar Park west of US 183, including the extension of Lakeline Boulevard from Buttercup Creek to FM 1431. No known caves documented to support the Tooth Cave ground beetle or any other species of concern occur within the 275 acres targeted for development. Reasonable and prudent measures intended to minimize incidental take of the Tooth Cave ground beetle include dedication of 163 acres around 12 tracts comprising the Buttercup Creek KFA as permanent conservation easements or deeded preserves, preserve maintenance, and access for research. The Tooth Cave ground beetle was found to occur in 25 caves included in this preserve of the 54 total caves identified on the entire tract.

Golden-cheeked warbler

As with the Tooth Cave ground beetle, the GCW is threatened by continuing urbanization and subsequent destruction or degradation of habitat within the action area. Construction of commercial and residential developments within and around the study area continue to eliminate, fragment, and degrade potential GCW nesting, fledging and feeding habitats. The smaller tracts of adequate habitat from encroaching urbanization in the action area, increases the risk of nest parasitism and reduces successful nesting and fledging. Although development projects are under construction now within the project vicinity that may be eliminating nesting habitat for GCW and resulting in negative impacts to the species, no previous consultations (either Section 7 or Section 10 permits) regarding the GCW have taken place within the project area.

IV. Effects of the Action

a. Factors to be considered

Tooth Cave ground beetle

The primary threat to the listed karst invertebrates is loss of habitat due to urban development activities. This loss may occur in association with a number of factors, including filling cave entrances or collapse of cave ceilings due to construction activities; alteration of natural drainage patterns (by activities such as altering topography, increasing impervious cover, installing berms or water collecting devices), resulting in drying or flooding; loss or degradation of the surface plant and animal communities, resulting in changes to moisture, temperature, or nutrient regimes of the karst ecosystem or increases in predation and/or competition; pollution; increasing invasion of fire ants; and, increased human visitation, vandalism, and dumping. These factors to be considered are discussed below.

Landscape Alteration. Filling in or collapsing of karst features threatens the karst invertebrates directly by killing individuals and destroying vital habitat. Destruction of karst features also reduces or may totally block the input of nutrients and moisture. Nutrient sources such as leaf litter and accidental species cannot fall into a closed cave. Based on the degree of filling, larger troglomenes such as raccoons may no longer be able to access the cave. Even if smaller troglomenes such as cave crickets are still able to access a partially filled cave, the habitat quality may have been degraded by increasing the cost of foraging (Helf et al. 1995).

The drainage patterns of karst features may be altered during construction by altering topography of the landscape: adding curbs, berms, drainage ditches, or storm drains, for example; or, by increasing impervious cover (the surface area covered by buildings, roads, parking lots, or other construction, that impedes normal rainwater infiltration into the soil) over the drainage area of the cave. These alterations can lead to either an increase or a decrease in the total amount of water flow into a cave, or they may change the rate or periodicity of water flow into the cave. Impervious cover prevents the natural process of water percolating into the ground, moving slowly toward aquifers, and being partially taken up by plants. If added run-off from impervious cover is drained toward the cave, the frequency and magnitude of flooding to the cave could be increased, and the added run-off could also carry contaminants into the karst system.

Pollution. Caves are susceptible to pollution from contaminated water entering the ground because the honeycombed karst limestone has little capacity for water purification. Pollutants may be derived from urban run-off; pesticides and fertilizers that are broadcast, sprayed, or fogged; hazardous materials; pipeline and storage tank leaks; power transformer and industrial accidents; leakage from septic systems, landfills, and sewer lines; and other sources. Karst systems can also be contaminated by sedimentation caused by soil erosion that accompanies development and clearing of vegetation. Primary routes of contaminant entry into karst ecosystems include the surface and subsurface drainage basin of a karst ecosystem; air (for airborne contaminants); and disposal of household garbage, construction debris, motor oil, and other materials directly into cave entrances. Such items may either be toxic or the excess organic waste may alter the nutrient balance of the cave and increase levels of competing species

from the surface (Culver 1986). The surface and subsurface drainage basins that supply water to the ecosystem have the greatest potential to carry contaminants into the karst. However, the potential for contaminants to travel through karst systems outside these basins may be extensive in some cases. For example, hydrocarbon fumes were detected in three caves up to 1.7 miles northeast of the site of a major oil spill in south Austin in 1987, despite cleanup efforts (Russell 1987).

Alteration of Vegetation and the Surface Ecosystem. The karst ecosystem is supported and sustained by the surface vegetation and animal communities. Since the nutrient input to the cave environment depends completely on inputs from the surface, changes in the surface communities will have impacts on the karst communities, including the listed species. The karst faunal communities evolved over thousands of years under oak/juniper woodland and savannah. The extent to which they can tolerate changes in the surface flora and fauna is unknown. The direct removal of native vegetation or development-induced changes in microclimate can lead to changes in plant community composition, which may in turn lead to shifts in the animal communities, especially the troglodytes which provide critical nutrients to the caves. Removal of vegetation may result in increased temperatures of the surrounding environment, increased exposure to wind for the surface community and cave entrance (making it less humid), increased drying of the surface community, and the increased potential for sedimentation from soil erosion. Shifts in the plant community can lead to an increase in non-native plant and animal species and loss or declines in species critical to the nutrient regime of the cave (for example cave crickets, harvestman, raccoons) due to habitat loss, predation, or competition.

Adequate areas of native vegetation are essential for preventing detrimental “edge effects” to the plant and animal species that are critical for sustaining the karst environment. Edge effects are changes to the floral and faunal communities, such as higher temperatures, drying, shift in species composition and abundance, increased predation/competition, and invasion of exotic species, where different habitats meet (forest/pasture, forest/clear-cut, or forest/suburb, for example). The length and width of the edge, as well as the contrast in types of land cover between the habitats, all contribute to the amount of impacts that an edge can produce (Smith 1990 ; Harris 1984). There are two types of edges, hard and soft. “Hard” edges, also called inherent edges, are drastic differences in habitat types, such as grassland to road, forest to clear-cut, and are generally long-term or permanent changes. “Soft” edges are subtle differences in habitat type (Smith 1990).

For vegetation, documented edge effects extend inward from the margin to between 52 and 449 feet (Chen et al. 1992 ; Stefen and Fairweather 1997; Meiners and Steward 1999). The length and width of the edge, as well as the contrast between the vegetation communities, all contribute to the amount of impacts (Smith 1990; Harris 1984). Some types of edge effects include increases in solar radiation, changes in soil moisture due to elevated levels of evapotranspiration, wind buffeting (Ranny et al. 1981), changes in nutrient cycling and the hydrological cycle (Saunders et al. 1990), and changes in the rate of leaf litter decomposition (Didham 1998). These edge effects alter the plant communities, which in turn impact the associated animal species. These edge effects have resulted in decreased density of trees, elevated tree mortality, increased growth rates and recruitment of dominant species which can lead to monoculture and

decreased species diversity (Meiners and Steward 1999), increased proportion of exotic species, and decreased proportion of native species (Stefan and Fairweather 1997).

For animal communities, reported edge effects are typically 164 to 328 feet or greater (Andren 1995; Burke and Nol 1998; Didham 1998; Laurance 1991; Laurance and Yensen 1991; Lovejoy et al. 1986; Kapos et al. 1993; Reed et al. 1996; Suarez et al. 1998; Wilcove et al. 1986). Edges and their associated effects often allow just enough disruption for invasive species to gain a foothold where the native vegetation had previously prevented their spread (Kotanen et al. 1998; Meiners and Steward 1999; Saunders et al. 1990; Suarez et al. 1998). The invasion of red-imported fire ants is known to be aided by “any disturbance that clears a site of heavy vegetation and disrupts the native ant community” (Porter et al. 1988).

Fire Ants. Fire ants, which prefer open, sunny areas where soil and vegetation have been disturbed, pose a serious threat to the listed species and the ecosystems on which they depend. The fire ant is an aggressive predator and has a devastating and long-lasting impact on native ant populations and other arthropod communities (Porter et al. 1988; Porter et al. 1991; Porter and Savignano 1990; Vinson and Sorenson 1986). The relative accessibility of the shallow caves inhabited by the listed invertebrates makes them especially vulnerable to invasion by fire ants and other exotic species. In coastal southern California, Suarez et al. (1998) found that densities of another exotic ant species, the Argentine ant (*Linepithema humile*), that has a life history similar to the fire ant are highest within 328 feet and rare or absent beyond 656 feet of an urban edge. Native ant communities tended to be more abundant in native vegetation and less abundant in areas with exotic vegetation.

Vandalism. People visiting caves can also damage the cave environment (Culver 1986). Even the most conservation-minded visitors to the cave can inadvertently kill individuals of listed invertebrate species or disrupt or destroy habitat by compacting substrate or disturbing cover objects in the process of moving through restrictive passageways (Crawford and Senger 1988). Less conservation-minded visitors may also leave dead batteries, spent carbide (a headlamp fuel), and cigarette butts, all of which are toxic and may kill the listed species or their prey species. Human vandalism may include littering with beer cans, broken glass, food wrappers, graffiti, urine, and feces (although the food web of troglobites frequently depends on guano, human feces may not be suitable for troglobitic invertebrates (see review in Howarth 1983)). The addition of organic matter that is not a natural part of the system may lead to a change in community composition, including the introduction of new species that are detrimental to the cave (Howarth 1983).

Golden-cheeked warbler

Impacts to the GCW from the proposed action may include actual destruction of nesting and feeding habitat (i.e., clearing of oak-juniper woodlands) within the proposed project ROW; degradation of adjacent habitats due to edge effects that result in changes in natural vegetation communities; fragmentation of habitat blocks that results in vegetation patches too small to support territories for breeding and nesting; and disturbances to individuals during the nesting season resulting from highway construction and related activities.

Like many habitat specialists, GCW populations appear to be less stable in small habitat patches surrounded by urbanization (Engels 1995; Moses 1996; Arnold et al. 1996; Bolger et al. 1997; Coldren 1998). Studies indicate that the abundance of several bird species, including the warbler, is reduced within 656-1640 feet of an urban edge (Engels 1995; Arnold et al. 1996; Bolger et al. 1997; Coldren 1998). Coldren (1998) reported that golden-cheeked warbler occupancy declined with increasing residential development and roadway width. The Service considers these edge effects to include an area up to 300 feet from urban development activities.

TTA, through its consultants, conducted presence/absence surveys and habitat evaluation of the project area to determine the potential for effects of the proposed action on the GCW. The Service requires that three years of presence/absence data be provided to support conclusions of no effect in areas where the vegetation community appears suitable for the species. Because only one year of survey data were available and access was denied to some potential sites, the Service recommended that TTA assume that all potential habitat be considered occupied for the purposes of the section 7 consultation. Through analyses coordinated with the Service, TTA was able to update the quantities of habitat impacted in the April 18, 2001, letter from the previous quantities provided in the BA (TCB 2000). Also considered was the quality of the potential habitat, in order for TTA to formulate an appropriate conservation proposal. This allowed higher quality habitat a larger value than lower quality habitats. Habitat quality was based on vegetation structure of the site, patch size and the fragmentation/urbanization of the patch.

b. Analyses for effects and species' response to the proposed action

Direct and indirect effects, Tooth Cave ground beetle

Habitat loss resulting from urbanization impacts to cave ecosystems, such as will occur from the proposed action, is the primary threat to the continued existence of the Tooth Cave ground beetle. Direct impacts to the Tooth Cave ground beetle are anticipated as a result of the construction of the proposed US 183A project. Jug Cave, inhabited by the species, occurs within the proposed alignment of the highway for the preferred alternative of the project and will likely be completely destroyed. The proposed action will likely include filling the entrance to Jug Cave or collapse of cave ceilings due to construction activities for the highway. An indeterminate number of individuals of Tooth Cave ground beetle will be killed by the permanent destruction of the Jug Cave as a result of the proposed action. The FHWA and TTA determined that these impacts were unavoidable due to other project constraints that require this location of the project ROW.

The total loss of Jug Cave, and the unknown number of Tooth Cave ground beetles that inhabit the cave, is a significant impact to the species because it represents a permanent and complete loss of the population within the cave. The cave cannot be restored or replaced in the future.

Substantial impacts to Big Oak Cave and its associated cave fauna are anticipated from the proposed action as well, resulting in severe impacts to the cave and the Tooth Cave ground beetle. Big Oak Cave will be surrounded by the US 183A highway and left in a small, narrow median (Figure 7). Overall the area left around Big Oak Cave may be more than 10 acres, but the configuration will be up to 0.5 miles long and a maximum width of about 225 feet between

road surfaces. Big Oak Cave will be surrounded by roads on three sides, with the new ROW within about 150 feet to the east of the cave entrance. This will result in the alteration of natural drainage patterns, loss of the surface plant and animal communities around Big Oak Cave, and significantly increases the risk of pollution entering the cave.

Based on the best available scientific information, an area of at least 150 meters (492 feet) radius from the footprint of a cave and a minimum of 28 to 40 hectares (69 to 99 acres), depending on configuration and adjacent land use, is necessary to sustain the habitat of listed karst species. Construction and subsequent operation and maintenance of US 183A at the location identified as the preferred alternative will likely result in impacts to the Tooth Cave ground beetle indirectly by degrading the surface ecosystem around Big Oak Cave. This habitat degradation would occur due to the permanent loss of portions of the surface vegetation community necessary to support the cave ecosystem and the increase in roadway runoff associated with the construction and operation of US 183A. The increase in impervious cover (transforming vegetation cover to pavement) as a result of the proposed action may also affect the high moisture and stable temperature regime, needed by the Tooth Cave ground beetle in the caves and interstitial spaces by reducing rainfall infiltration and increasing the surface temperature in the area.

Pollutant runoff from the highway (either from a hazardous materials spill or inherent highway materials polluting storm water runoff) could also enter into the karst system through subsurface drainage and impact the karst environment and reduce the quality of the cave to support Tooth Cave ground beetle populations.

Raccoon Cave, which is located about 350 feet east of the proposed action, may experience minor impacts from the new roadway. Potential impacts of the proposed action on Raccoon Cave include modification of the surface and/or subsurface hydrologic regime and may result in habitat fragmentation and isolation. The action may also lead to the introduction of fire ants or other non-native species. The proposed action will reduce the surface area available for maintaining viable native plant and animal communities that currently support the karst ecosystems for such functions as nutrient input. The potential for vandalism of the caves may also increase as a result of the proximity of the proposed highway and associated urbanization.

In the context of the range-wide status of the species, these impacts from both direct and indirect effects do not appreciably reduce the likelihood of species survival or recovery. Despite the complete loss of Jug Cave, substantial impacts to Big Oak Cave, and minor impacts to Raccoon Cave, there are still a sufficient number of high quality caves and KFAs within the Cedar Park KFR (at least three) that contain the Tooth Cave ground beetle to ensure recovery of the species within this KFR is not precluded.

Direct and indirect effects, golden-cheeked warbler

The total impact to golden-cheeked warbler habitat for the proposed action was determined to be 203 acres at 5 separate distinct sites throughout the action area (Table 1; Figures 8-12), identified as units in the BA (TCB 2000). This includes 91.6 acres of direct loss by clearing of vegetation within the proposed project ROW, and 111.3 acres of indirect impacts to habitat adjacent to, and

within 300 feet of the proposed project ROW. Some habitat in the adjacent areas of Unit 10 will be fragmented so severely, it is assumed to be totally lost as a result of the proposed action.

The estimates of impacts to GCW habitat were updated from the November BA through a site visit and coordination of analysis between TTA consulting biologists and Service biologists. Table 1 represents the updated information on habitat and species occurrence for each unit. The following summary of each unit was taken from TCB (2000) and the January 12, 2001, site visit.

Table 1. Estimated area of potential golden-cheeked warbler habitat impacted by the US 183A project.

US 183A Unit	Acres in proposed ROW	Acres within 300' of proposed ROW
Unit 1 (Fig. 8)	10.2	12.7
Unit 4 (Fig. 9)	0.0	5.9
Unit 5 (Fig. 10)	10.8	16.3
Unit 9 (Fig. 11)	48.3	20.7
Unit 10 (Fig. 12)	22.3	55.8
Project Totals	91.6	111.3

Unit 1. This site is located near the northern terminus of the project and just south of the South San Gabriel River (Figure 8). Access for survey of the property was limited to only four small areas and by public roads. The area appears to have suitable habitat for GCW nesting, where land development has not impacted vegetation. Previous habitat analysis at this site (SWCA 1999) audibly confirmed the presence of a GCW in the vicinity of this site.

Unit 4. This site, along County Road 271, contains some characteristics of GCW habitat (Figure 9). All potential habitat is of marginal quality and located outside the proposed ROW, but within 300 feet of the ROW to the west. The potential habitat area was not surveyed for the presence of GCW and was therefore treated as potential habitat.

Unit 5. This site is along Blockhouse Creek (Figure 10) and was not accessible for surveys or close inspection of the vegetation characteristics. Analysis by aerial photos indicates the possibility of use by GCWs. Although the patch is small, it is located between two larger patches of potential habitat to the east and west. The potential habitat area occurs within and adjacent to the proposed ROW and has apparent qualities from low to moderate. Current ongoing expansion of the Blockhouse Creek residential subdivision west of the site may be eliminating GCW habitat at some of this site.

Unit 9. This site is the western side of a large patch of mature Ashe juniper-oak woodlands that appears to be suitable for GCW nesting. The site, about three-quarters of a mile long, is located

north of Brushy Creek Road and to the east of Buffalo Road, in Cedar Park (Figure 11). The ROW is already owned by the City of Cedar Park. The west side of the ROW is already a residential area and the east side of the site is currently undergoing clearing due to the expansion of the Forest Oaks residential subdivision. The site was surveyed for GCW presence from the proposed ROW in the spring of 2000. An observation (auditory) of a GCW was made near the midpoint of the site and off the ROW to the east. Since these surveys were completed, substantial vegetation has been cleared in the area of this siting (private actions not approved or permitted by the Service). Acreage of potential habitat was updated using November 2000 aerial photos to reflect current conditions based on the best available information.

Unit 10. This site is within a large woodland area considered moderate GCW habitat where the main lanes of US 183A proposed alignment curves eastward from the existing highway 183, extending north to South Brushy Creek (Figure 12). Most of site is already owned by the State, but the northeast portion is privately owned and access was not available. On several occasions during surveys in the spring of 2000, multiple male GCWs were observed at this site and indications were made that nesting was occurring in the area.

There is not enough information available on GCW use of these areas to determine population sizes or number of possible territories or nests that may be present in the sites to be impacted. Based on the observations that were made, the quality and location of the potential habitat, these areas are probably used by GCWs in relatively low densities. While the impacts of the continuing loss of habitat of the GCW are significant, these areas are likely small peripheral populations compared to the core habitats with larger population blocks of GCWs, which are located many miles south and west of the project location.

b. Beneficial effects

The acquisition and preservation of two caves containing Tooth Cave ground beetle, as part of the proposed action, will be a beneficial effect for the species. This project feature was included to minimize the overall impacts to the species from the proposed action. The number of caves to be preserved was based on the level of impact to the caves and the existing quality of the impacted caves. The total destruction of a “low quality” cave, Jug Cave, and the severe impacts to a “medium quality” cave, Big Oak Cave, each warranted the preservation of a cave containing the Tooth Cave ground beetle. The quality of each cave is simply a factor of the existing impacts to the cave ecosystem associated with urbanization.

The contribution of funds for the conservation of GCW will also be beneficial to the species through habitat preservation and/or other means of supporting specific projects for the species. The amount to be contributed was based on a per-acre assessment of impacts to GCW habitat from the project area. TTA, in close coordination with the Service, applied a ratio for each acre of direct loss and indirect impacts to GCW habitat based on the status of the habitat being affected. This provided an overall quantity of impacts to be considered as 144 acres. TTA evaluated a market analysis for values of unimproved land in the vicinity of the project based on comparable recent sales to estimate a reasonable per-acre dollar amount to contribute. This analysis resulted in an estimated value of \$7,500 per acre. This figure was determined to be adequate to cover the necessary expenses for land purchase, monitoring, operation and

maintenance of about 144.03 acres of GCW habitat within a larger preserve system. The total amount for contribution was determined by multiplying \$7,500 by 144.03 acres for a total contribution of \$1,080,225.

V. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Southern Williamson and northern Travis counties have undergone rapid and sustained development and continue to be a fast-growing urban area, including the land in the vicinity of the US 183A project. For example, Williamson County has the second largest rate of population increase for any county in Texas. The 2000 census results reported a County population of just under 250,000, representing a 79% increase since 1990 (Texas State Data Center, <http://census.tamu.edu/> Table 23). Secondary/cumulative impacts of the entire project are discussed in greater detail in the US 183A EIS (Section 4.12). It can be assumed that, with or without the proposed action, urban development will continue to encroach upon the important areas for listed species in the action area. However, the proposed action to facilitate transportation from the Leander/Cedar Park communities to Austin will be a factor in the rate and location of future urbanization. Much of the land adjacent to the existing US 183 as well as the proposed US 183A is currently being commercially developed. As the natural environment is developed and converted to urban land, the ecosystem dynamics that influence both the Tooth Cave ground beetle and GCW habitat will likely be altered to the detriment of these species.

VI. Conclusion

After reviewing the current status of the Tooth Cave ground beetle and the golden-cheeked warbler, the environmental baseline for the action area, the effects of the proposed US 183A project, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Tooth Cave ground beetle or the golden-cheeked warbler. No critical habitat has been designated for these species, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be undertaken by the FHWA so that they become binding conditions of any grant or permit issued to the TTA or other parties, as appropriate, for the exemption in section 7(o)(2) to apply. FHWA has a continuing duty to regulate the activity covered by this incidental take statement. If FHWA (1) fails to assume and implement the terms and conditions or (2) fails to require TTA or other parties to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, FHWA must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take Anticipated

The Service anticipates take of Tooth Cave ground beetle in three caves as a result of this proposed action. The incidental take is expected to be in the form of killing of individuals in Jug Cave that is within the proposed project ROW of US 183A and will be totally destroyed during construction of the highway. Take of Tooth Cave ground beetles in Big Oak Cave will be in the form of harm, due to severe impacts to the cave, resulting in habitat loss for the species. Raccoon Cave occurs within the impact area of the proposed highway ROW and would be subject to minor impacts to the cave ecosystem that could result in harm to Tooth Cave ground beetles.

It is not possible to quantify the number of individuals that will be lost when Jug Cave is destroyed because of the limitations in population assessments described earlier in the biological opinion. The Service usually measures the status of karst invertebrate species populations, such as the Tooth Cave ground beetle, based on the number and location of discrete occupied caves and their condition. Karst habitats for this species cannot be recreated, so the loss of an occupied cave is a permanent reduction in the total population size of this species. Because of the small size of the Tooth Cave ground beetle and the nature of its habitat (caves), documenting any dead or impaired specimens is unlikely. The Service anticipates that all individuals occupying Jug

Cave will be killed as a result of the proposed action. Severe impacts to Big Oak Cave will likely harm most or all of the individuals occupying that cave.

Some Tooth Cave ground beetles in Raccoon Cave, which occurs within 150 meters east of the proposed project ROW, will be adversely impacted due to habitat alteration that will likely lead to declines in the quality of habitat provided by this cave. The proposed action should not lead to the complete loss of the cave as habitat for the Tooth Cave ground beetle.

The Service anticipates take of golden-cheeked warbler as a result of the proposed action in the form of harm due to habitat destruction and impacts. The total habitat impacted is determined to be 202.9 acres. This includes 91.6 acres of direct loss by clearing of vegetation within the proposed project ROW; 81.9 acres of indirect impacts to habitat adjacent to, and within 300 feet of the proposed project ROW; and 29.4 acres of adjacent habitat that is fragmented so severely, it is assumed to be totally lost as a result of the proposed action.

Effect of the take

In the accompanying biological opinion, the Service determined that this level of anticipated incidental take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat, since none has been designated.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the Tooth Cave ground beetle and golden-cheeked warbler.

1. Karst preserve. FHWA / TTA, and any designee, will establish one or more high quality karst preserve(s) which would include at least two distinct caves known to contain the Tooth Cave ground beetle, as proposed in the BA (*Conservation Options 3.2.1 Karst Invertebrates*) and the amended project description submitted by letter on April 18, 2001. The karst preserve(s) will minimize the impacts of the proposed action to construct US 183A by preserving caves known to contain the Tooth Cave ground beetle, consistent with recovery plan objectives.
2. Storm water quality protection. FHWA / TTA, and any designee, will install the best available storm water quality treatment measures, including hazardous materials traps where feasible and beneficial to the karst ecosystem, to provide for nondegradation of water quality runoff from the proposed project. These protective measures should be emphasized throughout the project area in karst zones 1 and 2, during both construction and operation of the proposed US 183A project. Protection of high quality runoff of storm water will minimize the potential for habitat degradation within the karst ecosystem of the project area.
3. Construction monitoring. FHWA / TTA, and any designee, will follow the procedural recommendations made by the Service in Appendix A of this biological opinion, to ensure any unknown caves that may be encountered during construction are identified and it is determined whether listed species may be present. This will ensure that incidental take of Tooth Cave

ground beetle does not exceed the level authorized by this incidental take statement and ensure other listed karst invertebrates are not present in newly discovered caves.

4. Right-of-way maintenance. FHWA / TTA, and any designee, will maintain the proposed US 183A ROW areas within karst zones 1 and 2 specifically to avoid the use of potential contaminants (fertilizers, pesticides, and herbicides) and to avoid the introduction of non-native species, primarily fire ants and implement specific actions to control fire ants within the ROW. The ROW should be managed by use of low-maintenance native vegetation.

5. Minimize GCW habitat impacts. FHWA / TTA, and any designee, will develop specific construction schedules and locations in order to minimize the loss of oak-juniper woodlands that serve as nesting habitat of golden-cheeked warblers and avoid clearing nesting habitat during the golden-cheeked warbler breeding season.

6. Conservation Fund. FHWA / TTA, and any designee, will make a financial contribution in the amount of \$1,080,225 to a Service-approved conservation fund to be utilized for the benefit of the golden-cheeked warbler, as proposed in the amended project description submitted by letter on April 18, 2001.

7. Construction controls. FHWA / TTA, and any designee, will not allow construction or land clearing activities in areas identified as karst zones 1 or 2 or in potential habitat of the golden-cheeked warbler outside of the areas for construction of the highway ROW and related facilities without prior approval from the Service.

Terms and conditions

To be exempt from the prohibitions of section 9 of the Act, FHWA must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Karst preserve.

A. Preserve acquisition. FHWA / TTA, and any designee, will develop a karst preserve plan, as proposed in the April 18, 2001, letter and submit this plan to the Service for review and concurrence prior to any construction activities related to the proposed US 183A project. The karst preserve plan shall describe, in detail, all of the necessary proposed actions associated with the acquisition (either fee simple or permanent conservation easement), including responsible parties, time frames and funding mechanisms. The best available science for karst preserve design will be used in the preparation of the karst preserve plan. The Service prefers that a high quality karst preserve include at least 70 to 100 acres of undeveloped land, with inhabited caves no closer than 150 meters to urban areas.

B. Preserve management. FHWA / TTA, and any designee, will develop a karst management plan for the acquired preserve(s) and submit this plan to the Service for review

and concurrence prior to any construction activities in karst zones 1 or 2, related to the proposed US 183A project. The karst management plan shall provide a commitment by FHWA, TTA or its designee for long term management and monitoring of the proposed karst preserve, including responsible parties, time frames and funding mechanisms. The best available science for karst preserve design shall be used in developing the karst management plan. The duration of preserve management will be for the life of the US 183A project. For purposes of this consultation, the life of the US 183A project is defined as the duration of the roadway operation.

2. Storm water quality protection. FHWA / TTA, and any designee, will submit a copy of the Water Pollution Abatement Plan (WPAP) to the Service for review and comment, concurrent with submission to the Texas Natural Resource Conservation Commission.
3. Construction monitoring. FHWA / TTA, and any designee, will provide a written report to the Service following completion of excavation and grading of areas within karst zones 1 and 2. This report will document compliance that the construction activities were monitored for the potential discovery of new caves. The report will provide detailed descriptions of the persons responsible for the monitoring (including their qualifications), the time spent in the field, and the results of any voids encountered.
4. Right-of-way maintenance. FHWA / TTA, and any designee, shall prepare a ROW maintenance plan for the US 183A project within Karst Zones 1 and 2 that includes protective measures to minimize potential impacts on the karst ecosystem and submit the plan to the Service for review and comment at least 30 days before the US 183A project is operational.
5. Minimize GCW habitat impacts. FHWA / TTA, and any designee, will limit the schedule of vegetation clearing in areas identified as potential golden-cheeked warbler habitat (Figures 8-12) to only occur between August 15 and March 1 to avoid the GCW breeding and nesting season. Where practicable, FHWA and TTA will minimize the construction limits in areas identified as potential GCW habitat.
6. Conservation Fund. FHWA / TTA, and any designee, will make payment to the conservation fund in the amount of \$1,080,225, and will be verified to the Service, prior to any construction activities on the proposed US 183A project. The funds will be held by a third party, approved by the Service, and used for future projects to benefit recovery of the golden-cheeked warbler. The first priority for use of these funds will be for habitat preservation in areas in proximity to the US 183A project area. Any use of these funds will occur only with the approval of the Service and with written notification to FHWA and TTA.
7. Construction controls. FHWA / TTA, and any designee, shall alert all potential contractors in writing to the potential presence of federally listed species within karst zones 1 and 2 (Travis and Williamson Counties). FHWA / TTA shall notify all contractors in writing that no construction-related activities outside the proposed ROW within karst zones 1 and 2 are approved under this consultation. And, FHWA / TTA shall inform all contractors in writing that should the contractor decide to pursue project specific locations (for example, haul roads, borrow sites, disposal sites, storage areas, staging areas, etc.) or other project-related activities outside the

proposed US 183A ROW, but within karst zones 1 or 2, or other potential endangered species habitat, the contractor shall be responsible for obtaining approval for the activities from the Service prior to initiation of such activities.

The Service believes that Tooth Cave ground beetle in no more than three caves will be impacted (one cave will be completely destroyed) as a result of the proposed action. In addition, approximately 202.9 acres of GCW habitat will be directly or indirectly impacted. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of impact is exceeded, such incidental take represents new information requiring re-initiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately stop the activity causing the take and provide an explanation of the causes of the taking. Reinitiation of section 7 will be required to review the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Regional conservation of endangered species in Williamson County. The Service recommends that FHWA and TTA take a proactive role in endangered species conservation in Williamson County. County officials have recently notified our office of their desire to initiate a regional approach to conservation of federally listed species within their County, with the ultimate goal of recovery of these species, to the extent practicable. FHWA and TTA have financial resources and technical expertise (hydrogeology, mapping tools, land use planning data, etc.) that could be utilized to participate and coordinate with this effort.
2. Regional GIS. FHWA and TTA should fund the necessary GIS mapping and spatial data analysis to assist in the development of a regional plan for conservation of listed karst invertebrates, the golden-cheeked warbler, black-capped vireo, and the salamanders of concern. This measure would also serve as an important tool for any future road construction projects by FHWA or TTA that would assist in avoiding impacts to listed species.
3. Additional conservation activities on the karst preserve. Within the karst preserve management plan, a number of voluntary activities could be undertaken by TTA that would enhance the biological value of the preserve and benefit the scientific understanding of karst invertebrate ecology.
 - A. Biological surveys of the currently known features and more thorough surveys for additional karst features within the preserve boundaries may reveal additional caves inhabited by the listed species.
 - B. Restoration activities for caves that have been previously impacted by other parties may also be appropriate.

- C. Investigations to study karst invertebrate ecology could be developed and implemented for caves to assist in future conservation management of the species.

4. Jollyville Plateau salamander conservation. The Jollyville Plateau salamanders are rare species that have no formal protection under the Endangered Species Act and are known to occur in the vicinity of US 183A. On November 1, 2000, the Service provided a letter to TTA responding to a request for our input on conservation measures that could be reasonably incorporated into the highway project designs that would protect these species. By reference of this letter, the Service reiterates those recommendations to be considered by FHWA and TTA for conservation of this rare species.

5. Education and outreach for karst invertebrate conservation. FHWA and TTA should develop an outreach program (printed materials, website, visual presentations , etc.) with the specific purpose of public education about the conservation of listed karst invertebrates in Williamson and Travis counties. The program would increase public awareness of the unique karst resources (without identifying any specific locations of sensitive caves) and cave fauna and emphasize the conservation needs of these ecosystems.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

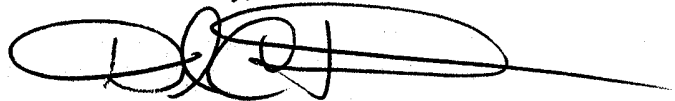
Re-initiation Notice

This concludes formal consultation on the action outlined in your request. As provided in 50 CFR § 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

As requested in your April 18, 2001, letter, we acknowledge the potential that reinitiation of consultation may be requested in order to update the quantities of GCW habitat impacts to reflect future private urban development in the project area. Reinitiation of consultation for this reason should occur before any construction activities are initiated and before the payment to a conservation fund is made. In addition, depending on the time lapse, reevaluation of the per acre fees proposed by FHWA/TTA may be required to reflect current land market values.

Because of the nature of the habitat of the Tooth Cave ground beetle (caves) and the location of the proposed US 183A project within areas known to have caves with this species, there is a reasonably high probability that additional caves may be discovered during construction. The project description includes specific monitoring procedures to ensure that the Service will be notified if and when this occurs. It will be imperative to determine if federally listed species are present in any newly discovered cave(s). If an additional cave (or caves) is discovered during project construction and is found to contain federally listed species, Section 7 consultation will need to be reinitiated immediately.

Sincerely,

A handwritten signature in black ink, appearing to read 'D. C. Frederick', with a long horizontal line extending to the right.

David C. Frederick
Supervisor

cc: Stacey Benningfield, TxDOT - TTA, Ausitin, Texas

Attachments:

Literature Cited
Figures 1 - 12
Appendix A

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APPENDIX A

Construction Monitoring for Endangered Karst Invertebrates

FHWA and TTA should include the following procedures for all construction activities in karst zones 1 and 2 for the proposed U.S. Highway 183 Alternative project.

1. During any land clearing or excavation (trenching, scraping, bulldozing, etc...) in karst zones 1 and 2 a qualified karst geologist will remain on-site to ensure detection of any caves, karst features, or subterranean voids that may be encountered. Excavation on the remainder of the project will not require a site geologist be present, but the procedures below will still be followed if any caves, karst features, or subterranean voids are encountered.
2. If any caves, karst features, or subterranean voids are encountered during construction, then construction work within 500 feet of the encountered voids will halt until project environmental consultants have completed necessary evaluations. The Service will be notified immediately. TTA will have a qualified karst geologist respond immediately to evaluate the void geologically to determine if it has the potential to contain endangered karst invertebrate habitat. If the potential for habitat is evident, TTA will have the feature examined by a Service-permitted Supervisory Biologist, approved by the Service, for the presence of the listed karst invertebrates, following Service protocols. At a minimum, three biological collection surveys will be conducted on three separate days over a period not greater than one week to determine the presence or absence of the listed invertebrates or other species of concern. Between surveys, voids should be covered to prevent drying, but still allow nutrient input. A report of the surveys, including climate data inside and outside of the cave, will be submitted to the Service immediately.
3. If no endangered, threatened or species of concern are determined to be present in an encountered feature, environmental consultants will issue specific instructions in accordance with standard practices accepted by Texas Natural Resource Conservation Commission, as applicable, for any particular void. Whether sealed or not, voids will not allow any contamination into the karst ecosystem. The Service will be notified of methods used for dealing with the void. Construction activity will then resume with the carrying out of those specific instructions.
4. If endangered, threatened or species of concern are determined to be present within an encountered feature, TTA will consult with the Service to determine avoidance or mitigation measures to implement (either on-site or off-site) depending, in part, on the species involved and the extent of effect. Upon completion or implementation of the avoidance procedures (following inspection and approval by geohydrologist), the work may resume. Reinitiation of section 7 consultation may be required impacts to listed species are unavoidable.

LIST OF FIGURES

Figure 1. Location and alignment of the preferred alternative for the proposed U.S. Highway 183 Alternative project, Williamson County, Texas.

Figure 2. Proposed alignment of the southern portion of the proposed U.S. Highway 183 Alternative project, Williamson County, Texas, showing the locations of the three caves in the project area.

Figure 3. Karst zones and cave locations in the southern portion of the proposed U.S. Highway 183 Alternative project, Williamson County, Texas.

Figure 4. Range of the Tooth Cave ground beetle, according to the 1994 Karst Invertebrate Recovery Plan (USFWS 1994).

Figure 5. Map of the breeding range of the golden-cheeked warbler in central Texas displaying the distribution of Ashe-juniper/oak woodland communities and the action area for the US 183 project.

Figure 6. Aerial photograph from November 2000 of the southern portion of the proposed U.S. Highway 183 Alternative project, Williamson County, Texas, showing recent urbanization relative to three caves in the project area.

Figure 7. Proposed alignment of U.S. Highway 183 Alternative project relative to the location of Big Oak and Raccoon caves.

Figure 8. Habitats of golden-cheeked warbler to be impacted by the U.S. Highway 183 Alternative project, Williamson County, Texas - Unit 1 (unit designations are from the November 2000 project BA).

Figure 9. Habitats of golden-cheeked warbler to be impacted by the U.S. Highway 183 Alternative project, Williamson County, Texas - Unit 4 (unit designations are from the November 2000 project BA).

Figure 10. Habitats of golden-cheeked warbler to be impacted by the U.S. Highway 183 Alternative project, Williamson County, Texas - Unit 5 (unit designations are from the November 2000 project BA).

Figure 11. Habitats of golden-cheeked warbler to be impacted by the U.S. Highway 183 Alternative project, Williamson County, Texas - Unit 9 (unit designations are from the November 2000 project BA).

Figure 12. Habitats of golden-cheeked warbler to be impacted by the U.S. Highway 183 Alternative project, Williamson County, Texas - Unit 10 (unit designations are from the November 2000 project BA).